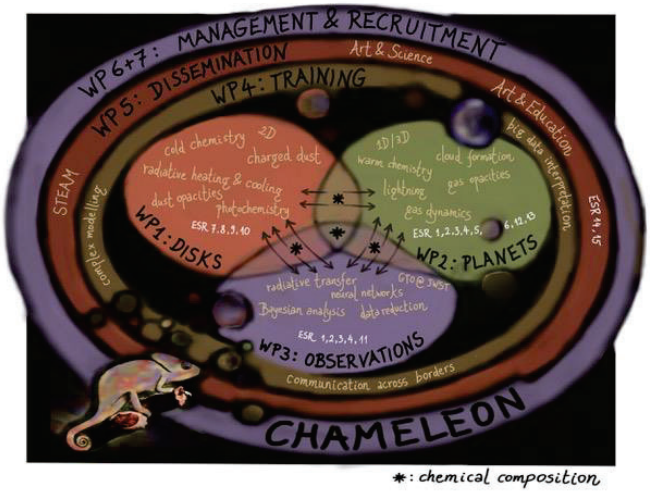
THE CHAMELEON MC ITN EJD FINALE

European Commission

MARIE CURIE ACTIONS



CHAMELEON: November 2020 kick-off → August 2024 finale

INSTITUT FÜR WELTRAUMFORSCHUNG

European Commission

Marie Skłodovska-Curie
Innovative Training Network (ITN
for European Joint Degrees (EJD)

MARIE CURIE ACTIONS

CHAMELEON
Virtual Laboratories
for Exoplanets and Planet-Forming Disks

6 European beneficiaries

IWF INSTITUT FÜR WELTRAUMFORSCHUNG
rijksuniversiteit groningen
UNIVERSITY OF COPENHAGEN
Universiteit Antwerpen
KU LEUVEN
THE UNIVERSITY OF EDINBURGH

15 PhD students

4 European partner institutions

SRON Dutch Space Research Institute
LUCA SCHOOL OF ARTS
DTU Space National Space Institute
TU Graz

OEAW.AC.AT/IWF

ÖAW IWF

CHAMELEON:

MC ITN EJD

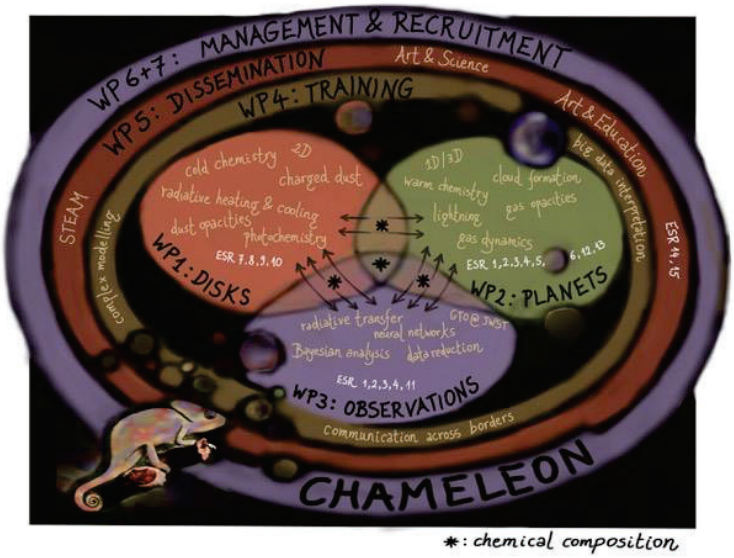
MARIE CURIE ACTIONS

CHAMELEON
Virtual Laboratories
for Exoplanets and Planet-Forming Disks

WP 1:
Modelling planet-forming disks
(Peter Woitke, Graz)

WP 2:
Modelling exoplanet atmospheres
(Leen Decin, Leuven)

WP 3:
Predicting observations & Data analysis
(Uffe G. Jørgensen, Copenhagen)



INSTITUT FÜR WELTRAUMFORSCHUNG

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CHAMELEON:

MC ITN EJD

MARIE CURIE ACTIONS

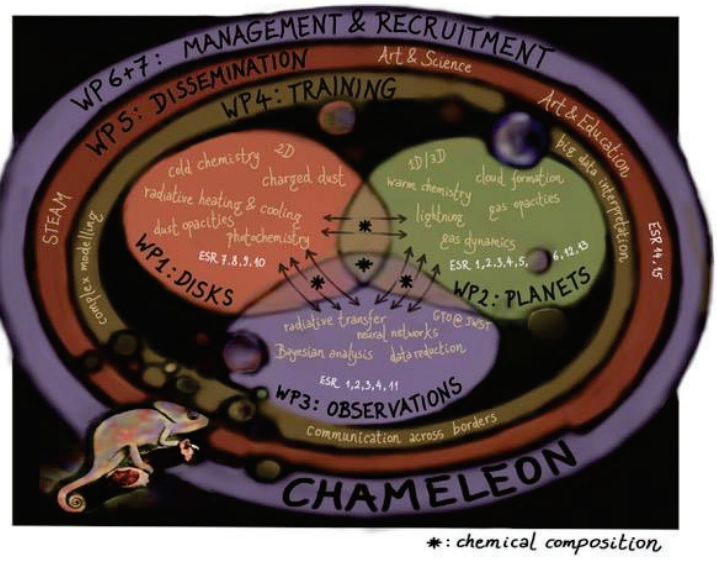
CHAMELEON
Virtual Laboratories
for Exoplanets and Planet-Forming Disks

Scientific output:

120 entries on ADS
(40 ESR first authored)
+ observational proposals
(JWST etc.)

Scientific network events:

3 CHAMELEON Schools
24 Network research meetings
44 Supervisor meetings
5 Supervisor board meetings
33 ESR meetings
2 ESR retreats



PhD degrees:

3 finalized (= 3 new Dr.s)

3 submitted

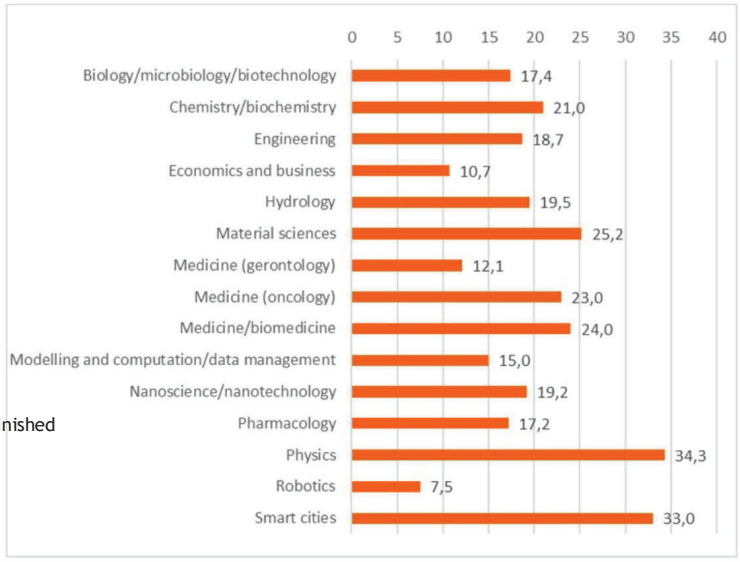
4 about to be submitted

Wanted: 15 Dr.s

CHAMELEON:

MARIE CURIE ACTIONS

CHAMELEON Achievements
in the context of EU survey of MC ITNS



domain averaged publication numbers

MC ITN 2014-2017, all finished
118 projects analysed

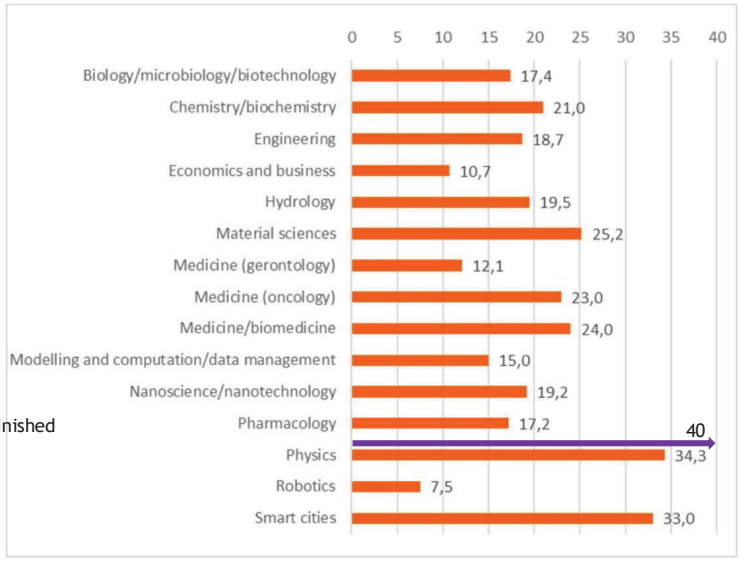
(Bitsios et al. 2023)

INSTITUT FÜR WELTRAUMFORSCHUNG

CHAMELEON:

MARIE CURIE ACTIONS

CHAMELEON Achievements
in the context of EU survey of MC ITNS



domain averaged publication numbers

MC ITN 2014-2017, all finished
118 projects analysed

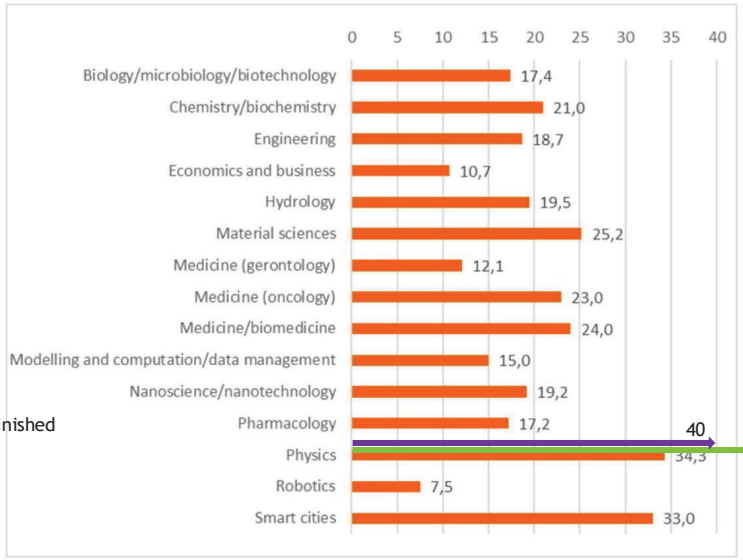
(Bitsios et al. 2023)

OEAW.AC.AT/IWF

CHAMELEON:

MARIE CURIE ACTIONS

CHAMELEON Achievements
in the context of EU survey of MC ITNS



domain averaged publication numbers

MC ITN 2014-2017, all finished
118 projects analysed

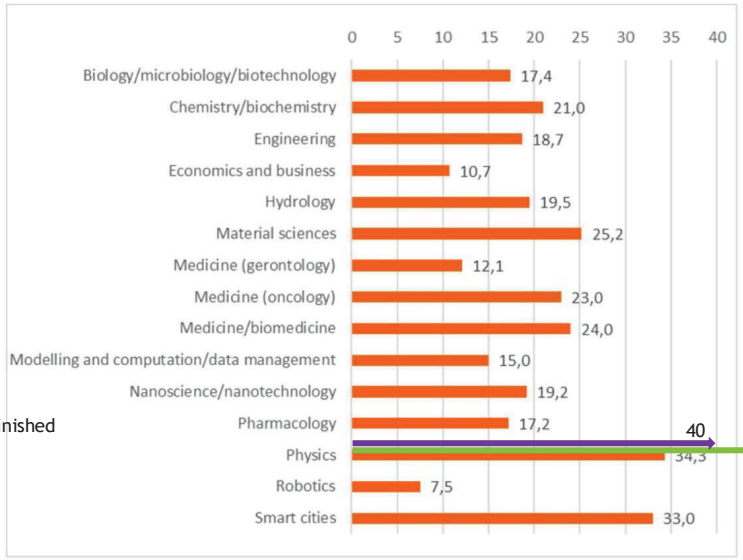
(Bitsios et al. 2023)

INSTITUT FÜR WELTRAUMFORSCHUNG

CHAMELEON:

MARIE CURIE ACTIONS

CHAMELEON Achievements
in the context of EU survey of MC ITNS



Science research papers only!

domain averaged publication numbers

MC ITN 2014-2017, all finished
118 projects analysed

(Bitsios et al. 2023)

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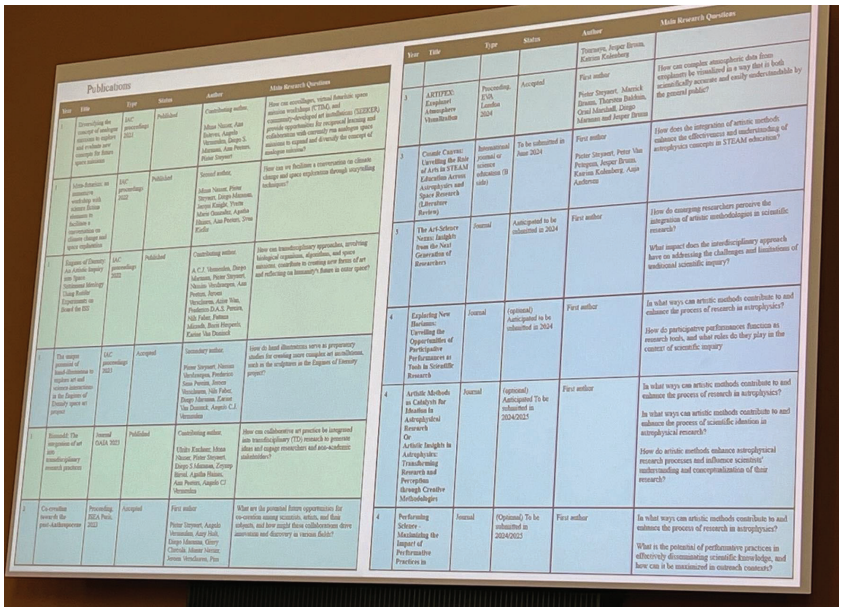

Title	Description	Theory	Data	Writing Progress	Journal
Clouds on Other Planets	Teaching cloud formation in a high school classroom using inquiry-based learning and cutting-edge exoplanet research	Inquiry-Based Science Education	Lesson material development documents	Published	Jaarboek De Ardijkskund
The development of an IBSE lesson using contemporary astrophysics research topics	An assessment of the methods used to develop the initial lessons. This will detail the input from the Scientist Teacher Partnerships during the Design-based research process	Scientist-Teacher Partnerships Inquiry-Based Science Education	Recordings from interviews, co-creation and feedback sessions with scientists and teachers	To be submitted in Summer 2024 (Finalising data analysis & results)	Astronomy Education Journal
Students Reactions to Inquiry-Based Science Lessons	A network analysis of student feedback that looks at how students react to the IBSE lesson developed for this project	Inquiry-Based Science Education Network Analysis	Written student feedback from lessons	To be submitted in June 2024 (Finalised - currently in internal revisions before submitting)	International Journal of Science Education
Students Uses and Limitations of Experiments as Physical Analogies	Framing experiments as physical analogies and analyzing the ways in which students use them as such in discussions about the topic.	Conceptual Metaphor Theory Analogical Scaffolding	Recordings of peer-lead interviews that were held after lessons	Accepted for GIREP Conference in August, paper to be submitted after feedback at conference	Science Education
Educational Material Co-Creation Leading to Scientific Collaborations	A description of the creation of lesson materials that use real data from exoplanet scientists	Didactic Transposition - Moving 'backwards' from 'knowledge to be taught' to 'scholarly knowledge'	Recordings of development meetings with scientists and written feedback from teachers	Predicted submission Autumn 2024. Data analysis to be conducted during ESEA summer school (August 2024)	Astronomy Education Journal

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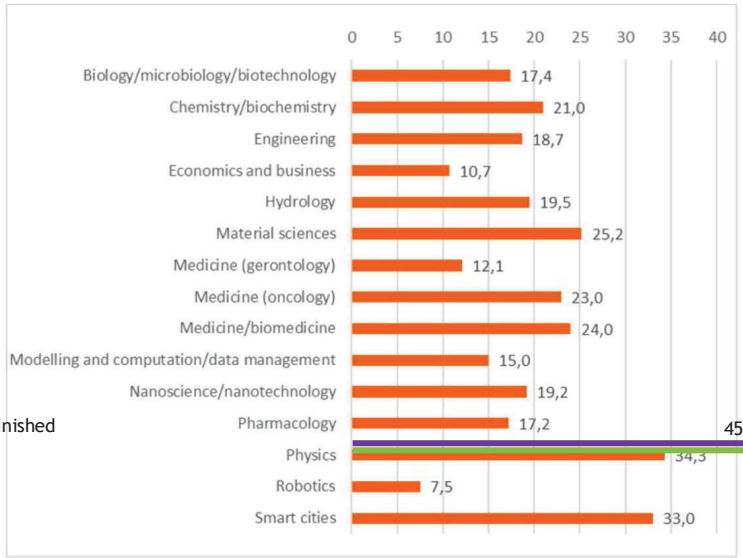
CHAMELEON:

MC ITN EJD

MARIE CURIE ACTIONS

CHAMELEON Achievements

in the context of EU survey of MC ITNS



Science, arts & education research publications

domain averaged publication numbers

MC ITN 2014-2017, all finished
118 projects analysed

(Bitsios et al. 2023)

CHAMELEON:

MARIE CURIE ACTIONS

CHAMELEON School Achievements

School I: getting to know the tools and their background

School II: 4 Space Mission proposals:

Solar Lens for Observing Terrestrial Habitats

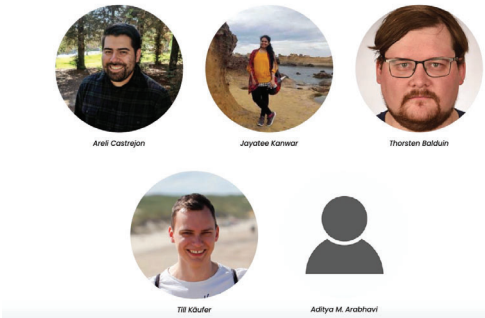
Imaging the surface of an exoplanet: how can we prove extraterrestrial life beyond any reasonable doubt?

Planets IN Extragalactic Areas Providing Population Levels: an Enormous Survey

A survey of planets outside of our own galaxy providing large scale exoplanet population statistics

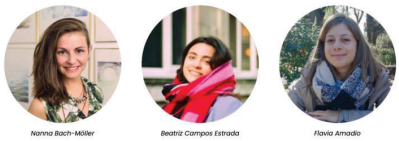
PlaDiPro: Circumplanetary Disk Probe

The first steps towards answering the open question of how planets form



Atmospheric Lunar Observatory for Non-Equilibrium

ɜn we find life on earth-like exoplanets by observing their chemical fingerprints?



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CHAMELEON:

MARIE CURIE ACTIONS

CHAMELEON School Achievements

School I: getting to know the tools and their background

School II: 4 Space Mission proposals
MEME exhibition

School III: 1 joint paper project on warm Saturn HATS-6b + 1 ALMA proposals + 2 JWST proposals
ESRs photoshoots (see *Huset* exhibition in Copenhagen) + MEME exhibition
Test lessons at local School

Under the magnifying glass: A combined 3D model applied to cloudy warm Saturn type exoplanets around M-dwarfs

S. Kiefer[1,2,3], N. Bach-Møller[2,3,4], D. Samra[2], D. A. Lewis[2,3], A. D. Schneider[1,4], F. Amadio[4,1], H. Lecoq-Molinos[2,3,1], L. Carone[2], L. Decin[1], U. G. Jørgensen[4], and Ch. Helling[2,3]

[1] Institute of Astronomy, KU Leuven, Celestijnenlaan 200D, 3001 Leuven, Belgium
e-mail: sven.kiefer@kuleuven.be
[2] Space Research Institute, Austrian Academy of Sciences, Schmiedlstrasse 6, A-8042 Graz, Austria
[3] Institute for Theoretical Physics and Computational Physics, Graz University of Technology, Petersgasse 16 8010 Graz
[4] Centre for ExoLife Sciences, Niels Bohr Institute, Øster Voldgade 5, 1350 Copenhagen, Denmark

(under review)

Detecting long hydrocarbons in the protoplanetary disks — **None Assigned**

ABSTRACT

Protoplanetary disks are the cradle of planet formation. The gas mass and chemical composition in these disks are among the most important properties. Knowledge of these quantities is most relevant to understand the planet formation process and the composition of planetary atmospheres. With the high sensitivity of ALMA, we can study the molecular and elemental abundances in these disks and constrain the C/S/N/O elemental ratios. Especially carbon with its chemical flexibility has a huge impact on the disk's chemistry. These ratios can also be measured for the exoplanets thus being a connecting link between disks and planets. We propose to observe the two well-studied bright Herbig disks MWC480 and HD163296 to detect long-chain hydrocarbons in the outer disks to re-evaluate the C/O ratio and determine robustly the total carbon budget in these disks.

SCIENCE CATEGORY:	Circumstellar disks, exoplanets and the solar system				
ESTIMATED 12-M TIME:	15.1 h	ESTIMATED 7-M TIME:	0.0 h	ESTIMATED TP TIME:	0.0 h
DUPLICATE OBSERVATION JUSTIFICATION:	None of the sources have been observed in Band 3 with the sensitivity high enough to observe the targeted molecular lines.				

REPRESENTATIVE SCIENCE GOALS (UP TO FIRST 30)

CHAMELEON Achievements from ESR teams


Sven Kiefer


Nanna Bach-Møller

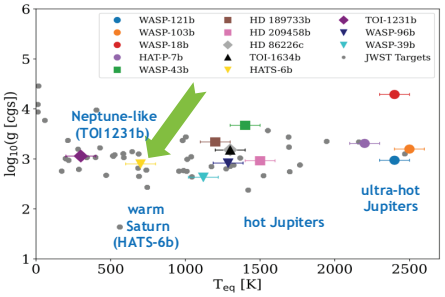

Aaron Schneider

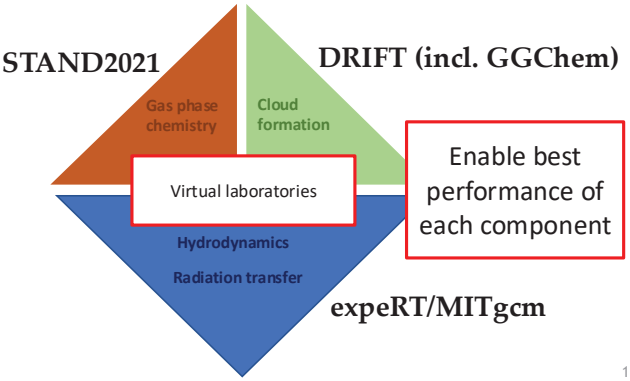

Flavia Amadio


Helena Lecoq M.

HATS-6B

A WARM SATURN ORBITING AN M-DWARF





CHAMELEON: MC ITN EJD

MARIE CURIE ACTIONS

CHAMELEON: MC ITN EJD

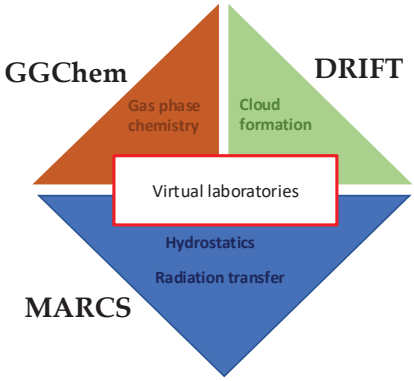
MARIE CURIE ACTIONS

A grid of self-consistent MSG (MARCS-StaticWeather-GGchem) cool stellar, sub-stellar, and exoplanetary model atmospheres

Uffe G. Jørgensen[1], Flavia Amadio[1,2], Beatriz Campos Estrada[1,3], Kristian Holten Møller[1], Aaron D. Schneider[1,2], Thorsten Balduin[1,3], Azzurra D'Alessandro[1], Eftychia Symeonidou[1,4], Christiane Helling[3], Åke Nordlund[1,5], and Peter Woitke[3]

[1] Centre for ExoLife Sciences, Niels Bohr Institute, University of Copenhagen, Øster Voldgade 5, 1350 Copenhagen, Denmark
e-mail: uffegj@nbi.dk
[2] Institute for Astronomy, KU Leuven, Celestijnenlaan 200D, 3001 Leuven, Belgium
[3] Space Research Institute, Austrian Academy of Sciences, Schmiedlstrasse 6, 8042 Graz, Austria
[4] Department of Biology, University of Copenhagen, Universitetsparken 15, 2100 Copenhagen, Denmark
[5] Rosseland Centre for Solar Physics, University of Oslo, PO Box 1029 Blindern, 0315 Oslo, Norway

+ Graz University of Technology, Graz, Austria



Enables to model two major science cases with one tool:

- Young, self luminous planets (+ brown dwarfs)
  (complete grid in **Campos Estrada et al. 2024**, submitted)
- Old, irradiated planets
  (complete grid in **Amadio et al. 2024**, in preparation)

CHAMELEON:

MC ITN EJD

MARIE CURIE ACTIONS

CHAMELEON Achievements
that open new avenues

Revisiting fundamental properties of TiO_2 nanoclusters as cond... seeds in astrophysical environments★

Vanadium oxide clusters in substellar atmospheres

A quantum chemical study

H. Lecoq-Molinos[1,2,3], D. Gobrecht[4], J.P. Sindel[1,2,5,6], Ch. Helling[1,3], and L. Decin[2]

[1] Space Research Institute, Austrian Academy of Sciences, Schmiedlstrasse 6, A-8042 Graz, Austria
e-mail: helena.lecoq@oeaw.ac.at
[2] Institute of Astronomy, KU Leuven, Celestijnenlaan 200D, 3001 Leuven, Belgium
[3] TU Graz, Fakultät für Mathematik, Physik und Geodäsie, Petersgasse 16, A-8010 Graz, Austria
[4] Department of Chemistry and Molecular Biology, University of Gothenburg, Sweden
[5] Centre for Exoplanet Science, University of St Andrews, North Haugh, St Andrews, KY169SS, UK
[6] SUPA, School of Physics & Astronomy, University of St Andrews, North Haugh, St Andrews, KY169SS, UK

Heterogeneous seed formation

ML treatment of nucleation: third-body funding (1PhD, 1 PostDoc)

FWF Der Wissenschaftsfonds.

INSTITUT FÜR WELTRAUMFORSCHUNG

CHAMELEON:

MC ITN EJD

MARIE CURIE ACTIONS

CHAMELEON Achievements
that open new avenues

Bayesian Analysis of Molecular Emission and Dust Continuum of Protoplanetary Disks

T. Kaeufer[1,2,3,4], M. Min[3], P. Woitke[1], I. Kamp[2], and A. M. Arabhavi[2]

[1] Space Research Institute, Austrian Academy of Sciences, Schmiedlstrasse 6, A-8042 Graz, Austria
e-mail: till.kaeufer@oeaw.ac.at
[2] Kapteyn Astronomical Institute, University of Groningen, PO Box 800, 9700 AV Groningen, The Netherlands
[3] SRON Netherlands Institute for Space Research, Niels Bohrweg 4, 2333CA Leiden, The Netherlands
[4] Institute for Theoretical Physics and Computational Physics, Graz University of Technology, Petersgasse 16, 8010 Graz, Austria

FlopPITy: enabling self-consistent exoplanet atmospheric retrievals with machine learning.

F. Ardévol Martínez[1,2,3,4], M. Min[2], D. Huppenkothen[2], I. Kamp[1], and P. I. Palmer[3,4]

[1] Kapteyn Astronomical Institute, University of Groningen, Groningen, The Netherlands
e-mail: ardevol@astro.rug.nl
[2] Netherlands Space Research Institute (SRON), Leiden, The Netherlands
[3] Centre for Exoplanet Science, University of Edinburgh, Edinburgh, UK
[4] School of GeoSciences, University of Edinburgh, Edinburgh, UK

JWST data interpretation

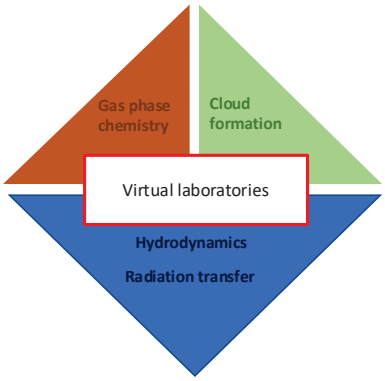
ÖAW IWF

CHAMELEON JWST Achievements

CHAMELEON:

MC ITN EID

MARIE CURIE ACTIONS



planet-forming disks

ProDiMo

DuCKLinG

extrasolar planets

ARCiS
FlopPITy

expert/MITgcm
DRIFT
GGChem
Claus

42-1
JWST CHAMELEON papers
50/50 planets/disk

full:"860470" year:2020-2025 abs:"JWST"

1 2024arXiv240705070T 2024/07
MINDS. The DR Tau disk II: probing the hot and cold H_2O reservoirs in the JWST-MIRI spectrum
Temmink, Milou; van Dishoeck, Ewine F.; Gasman, Danny and 14 more

2 2024A&A...687A.209K 2024/07
Bayesian analysis of the molecular emission and dust continuum of protoplanetary disks
Kaeufer, T.; Min, M.; Woitke, P. and 2 more

3 2024A&A...687A..96F 2024/07 cited: 2
MINDS: Mid-infrared atomic and molecular hydrogen lines in the inner disk around a low-mass star
Franceschi, Riccardo; Henning, Thomas; Tabone, Benoot and 27 more

4 2024arXiv240610217G 2024/06
MINDS. A multi-instrument investigation into the molecule-rich JWST-MIRI spectrum of the DF Tau binary system
Grant, Sierra L.; Kurtovic, Nicolas T.; van Dishoeck, Ewine F. and 26 more

5 2024Sci...384.1086A 2024/06 cited: 2
Abundant hydrocarbons in the disk around a very-low-mass star
Arabhavi, A. M.; Kamp, I.; Henning, Th. and 40 more

6 2024MNRAS.531.1471D 2024/06
The impact of ozone on Earth-like exoplanet climate dynamics: the case of Proxima Centauri b
De Luca, P.; Braam, M.; Komacek, T. D. and 1 more

7 2024A&A...686A.117T 2024/06 cited: 2
MINDS: The DR Tau disk. I. Combining JWST-MIRI data with high-resolution CO spectra to characterise the hot gas
Temmink, Milou; van Dishoeck, Ewine F.; Grant, Sierra L. and 29 more

8 2024A&A...686A.105V 2024/06
Examining the detectability of ringing on highly eccentric exoplanets
Vanrespaille, M.; Baeyens, R.; Schneider, A. and 2 more

9 2024PASP..136e4302H 2024/05 cited: 10
MINDS: The JWST MIRI Mid-INfrared Disk Survey
Henning, Thomas; Kamp, Inga; Samland, Matthias and 43 more

10 2024A&A...685A..63A 2024/05 cited: 1
The tidal deformation and atmosphere of WASP-12 b from its phase curve★
Akinsanmi, B.; Barros, S. C. C.; Lendl, M. and 85 more

11 2024NatAs.tmp....1B 2024/04 cited: 8
Nightside clouds and disequilibrium chemistry on the hot Jupiter WASP-43b
Bell, Taylor J.; Crouzet, Nicolas; Cubillos, Patricio E. and 80 more

12 2024A&A...683A.219W 2024/03 cited: 5
2D disc modelling of the JWST line spectrum of EX Lupi
Woitke, P.; Thi, W. -F.; Arabhavi, A. M. and 3 more

13 2024ApJ...962....8S 2024/02 cited: 4
MINDS. JWST/MIRI Reveals a Dynamic Gas-rich Inner Disk inside the Cavity of SY Cha
Schwarz, Kamber R.; Henning, Thomas; Christiaens, Valentin and 23 more

14 2024A&A...682A.150K 2024/02
Fully time-dependent cloud formation from a non-equilibrium gas-phase in exoplanetary atmospheres
Kiefer, S.; Lecoq-Molinos, H.; Helling, Ch. and 2 more

15 2024Natur.625...51D 2024/01 cited: 24
SO_2, silicate clouds, but no CH_4 detected in a warm Neptune
Dyrek, Achrene; Min, Michiel; Decin, Leen and 43 more

16 2024A&A...681A..47V 2024/01
Mid-infrared evidence for iron-rich dust in the multi-ringed inner disk of HD 144432
Varga, J.; Waters, L. B. F. M.; Hogerheijde, M. and 40 more

17 2024A&A...681A..22K 2024/01 cited: 5
Hydrocarbon chemistry in the inner regions of planet-forming disks
Kanwar, J.; Kamp, I.; Woitke, P. and 3 more

18 2023arXiv231203424W 2023/12
Physico-chemical Processes in Planet-forming Discs
Woitke, Peter

19 2023Natur.624..263B 2023/12 cited: 7
$^{15}NH_3$ in the atmosphere of a cool brown dwarf
Barrado, David; Molliere, Paul; Patapis, Polychronis and 40 more

20 2023ApJ...958L..30R 2023/12 cited: 5
XUE: Molecular Inventory in the Inner Region of an Extremely Irradiated Protoplanetary Disk
Ramirez-Tannus, Maria Claudia; Bik, Arjan; Cuijpers, Lars and 24 more

21 2023AN....34430075J 2023/12 cited: 1
The sulfur species in hot rocky exoplanet atmospheres
Janssen, L. J.; Woitke, P.; Herbort, O. and 4 more

22 2023A&A...680A..65S 2023/12
Infrared spectra of TiO_2 clusters for hot Jupiter atmospheres
Sindel, J. P.; Helling, Ch.; Gobrecht, D. and 2 more

23 2023A&A...679A.117G 2023/11 cited: 21
MINDS. Abundant water and varying C/O across the disk of Sz 98 as seen by JWST/MIRI
Gasman, Danny; van Dishoeck, Ewine F.; Grant, Sierra L. and 41 more

24 2023A&A...679A..92P 2023/11 cited: 3
CHEOPS and TESS view of the ultra-short-period super-Earth TOI-561 b
Patel, J. A.; Egger, J. A.; Wilson, T. G. and 75 more

25 2023FaDi..245..112K 2023/09 cited: 10
The chemical inventory of the inner regions of planet-forming disks — the JWST/MINDS program
Kamp, Inga; Henning, Thomas; Arabhavi, Aditya M. and 40 more

26 2023FaDi..245...52V 2023/09 cited: 17
The diverse chemistry of protoplanetary disks as revealed by JWST
van Dishoeck, Ewine F.; Grant, S.; Tabone, B. and 14 more

27 2023A&A...677A..38B 2023/09 cited: 5
TOI-2084 b and TOI-4184 b: Two new sub-Neptunes around M dwarf stars
Barkaoui, K.; Timmermans, M.; Soubkiou, A. and 67 more

28 2023Natur.620..516P 2023/08 cited: 34
Water in the terrestrial planet-forming zone of the PDS 70 disk
Perotti, G.; Christiaens, V.; Henning, Th. and 42 more

29 2023NatAs...7..805T 2023/07 cited: 49
A rich hydrocarbon chemistry and high C to O ratio in the inner disk around a very low-mass star
Tabone, B.; Bettoni, G.; van Dishoeck, E. F. and 43 more

30 2023Natur.617..483T 2023/05 cited: 100
Photochemically produced SO_2 in the atmosphere of WASP-39b
Tsai, Shang-Min; Lee, Elspeth K. H.; Powell, Diana and 82 more

31 2023ApJ...947L...6G 2023/04 cited: 43
MINDS. The Detection of $^{13}CO_2$ with JWST-MIRI Indicates Abundant CO_2 in a Protoplanetary Disk
Grant, Sierra L.; van Dishoeck, Ewine F.; Tabone, Benoot and 43 more

32 2023A&A...671A.122H 2023/03 cited: 18
Exoplanet weather and climate regimes with clouds and thermal ionospheres. A model grid study in support of large-scale observational campaigns
Helling, Christiane; Samra, Dominic; Lewis, David and 7 more

33 2023arXiv230108492C 2023/01 cited: 5
WASP-39b: exo-Saturn with patchy cloud composition, moderate metallicity, and underdepleted S/O
Carone, Ludmila; Lewis, David A.; Samra, Dominic and 2 more

34 2023A&A...669A.142S 2023/01 cited: 13
Clouds form on the hot Saturn JWST ERO target WASP-96b
Samra, D.; Helling, Ch.; Chubb, K. L. and 3 more

35 2022A&A...663A..47S 2022/07 cited: 7
Mineral snowflakes on exoplanets and brown dwarfs. Coagulation and fragmentation of cloud particles with HYLANDS
Samra, D.; Helling, Ch.; Birnstiel, T.

36 2022A&A...662A.108A 2022/06 cited: 13
Convolutional neural networks as an alternative to Bayesian retrievals for interpreting exoplanet transmission spectra
Ardevol Martinez, F.; Min, M.; Kamp, I. and 1 more

37 2022arXiv220301236A 2022/03 cited: 8
Convolutional neural networks as an alternative to Bayesian retrievals
Ardevol Martinez, Francisco; Min, Michiel; Kamp, Inga and 1 more

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Machine learning as an ultra-fast alternative to Bayesian retrievals
Ardevol Martinez, Francisco; Min, Michiel; Kamp, Inga and 1 more

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CHAMELEON:

MC ITN EJD

MARIE CURIE ACTIONS

CHAMELEON Achievements

exoplanet and disk research connection & heritage

particle charging & lightning

IONIZATION IN ATMOSPHERES OF BROWN DWARFS AND EXTRASOLAR PLANETS. III. BREAKDOWN CONDITIONS FOR MINERAL CLOUDS

Ch. Helling[1], M. Jardine[1], C. Stark[1], and D. Diver[2]
[1] SUPA, School of Physics & Astronomy, University of St. Andrews, St. Andrews KY16 9SS, UK; ch@leap2010.eu
[2] SUPA, School of Physics and Astronomy, University of Glasgow, Glasgow G12 8QQ, UK
Received 2012 July 6; accepted 2013 January 30; published 2013 April 5

Dust cloud lightning in extraterrestrial atmospheres

Christiane Helling [a], Moira Jardine [a], Declan Diver [b], Sören Witte [c]

Atmospheric electrification in dusty, reactive gases in the solar system and beyond

Christiane Helling[1], R. Giles Harrison[2], Farideh Honary[3], Declan A. Diver[4], Karen Aplin[5], Ian Dobbs-Dixon[6], Ute Ebert[7], Shu-ichiro Inutsuka[8], Francisco J. Gordillo-Vazquez[9], Stuart Littlefair[10]

...

Aggregation and charging of mineral cloud particles under high-energy irradiation

Nanna Bach-Møller [1,2,3] Christiane Helling [2,3] Uffe G. Jørgensen [1] and Martin B. Enghoff [4]

[1] *Centre for ExoLife Sciences, Niels Bohr Institute, Øster Voldgade 5, 1350 Copenhagen, Denmark*
[2] *Space Research Institute, Austrian Academy of Science, Schmiedelstraße 6, 8042 Graz, Austria*

Lightning-induced chemistry on tidally-locked Earth-like exoplanets

Marrick Braam [1,2,3★] Paul I. Palmer,[1,2] Leen Decin,[3] Robert J. Ridgway [4] Maria Zamyatina [4] Nathan J. Mayne,[4] Denis E. Sergeev[4] and N. Luke Abraham[5,6]

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[5] *Yusuf Ham*
[6] *National C*

Size-dependent charging of dust particles in protoplanetary disks

Can turbulence cause charge separation and lightning?

T. Balduin[1,2,3], P. Woitke[1,2], U. G. Jørgensen[3], W.-F. Thi[4] and Y. Narita[1]

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[2] TU Graz, Faculty of Mathematics, Physics and Geodesy, Petersgasse 16, 8010 Graz, Austria
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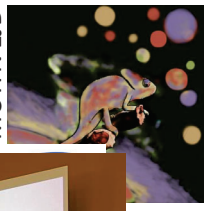

CHAMELEON Achievements

exoplanet and disk research connection + education

particle charging & lightning

Aggregation and charging of mineral cloud particles under high-energy irradiation

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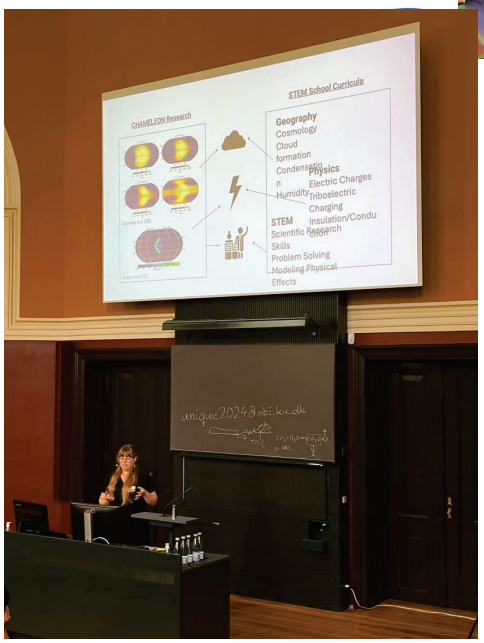
[4] Max Planck Institute for Extraterrestrial Physics, Giessenbachstrasse 1, D-85748 Garching, Germany



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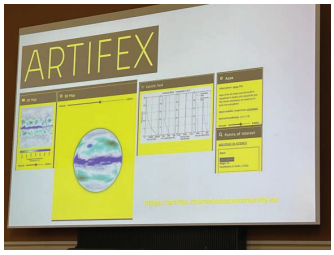
MARIE CURIE ACTIONS



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CHAMELEON:

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MARIE CURIE ACTIONS

CHAMELEON Achievements

that connect exoplanet and disk research

kinetic carbon gas-phase chemistry

extrasolar planets

A CHEMICAL KINETICS NETWORK FOR LIGHTNING AND LIFE IN PLANETARY ATMOSPHERES

P. B. Rimmer and Ch Helling
School of Physics and Astronomy, University of St Andrews, St Andrews, KY16 9SS, UK; pr33@st-andrews.ac.uk
Received 2015 June 3; accepted 2015 October 22; published 2016 May 23

extrasolar planets

- Jayatee Kanvar Chapter 4: 3-body process, high/low pressure limit, reaction reversal via thermodynamic data
- New mixing formalism for ProDiMo inspired by ARGO from Rimmer & Helling (2016)

Mixing and diffusion in protoplanetary disc chemistry

P. Woitke[1,2,3], A. M. Arabhavi[2,3,4,5], I. Kamp[4], and W.-F. Thi[6]

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CHAMELEON IN SPACE

CHAMELEON:

MC ITN EID

MARIE CURIE ACTIONS

14 CHAMELEON papers

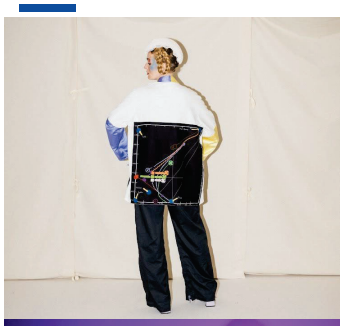
42-1 CHAMELEON papers
50/50 planets/disk

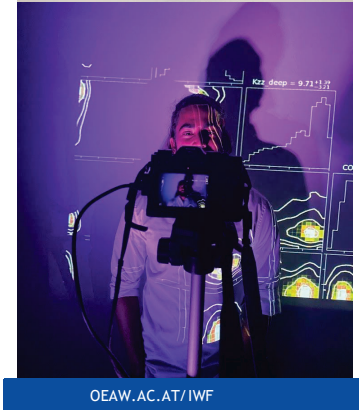
WPs 116700, 116800 (IWF)

Science Team Members:
SRON, IWF, Leuven

Beyond 2035: NewATHENA, Habitable World Observatory

CHAMELEON: November 2020 kick-off → August 2024 finale





CHAMELEON
Achievements
exoplanet and disk research connection
+ arts

Exploring Exoplanets

All events take place at XENON, which is located c

Join us from Monday, July 29th to Friday, August 2nd, at Huset C
series that seamlessly intertwines art and science. Presented in
Planet" at the University of Copenhagen, this event is independe

"Exploring Exoplanets" stems from the research of Pieter Steyae
specifically exoplanet research. The exhibition showcases a limit
designs, photographs, and video installations.

Beyond the exhibition, we offer a series of engaging activities. E
humor and astrophysics with improv comedy from Improv Come
visualization workshops. Additionally, immerse yourself in the life
wednesday morning we host educational activities for kids.

Among the facilitators of these activities are astronomers Anja C
Marshall, space architect and biologist Angelo Vermeulen and a

Most activities are conducted in English, with assistance availab

We look forward to welcoming you to Huset Copenhagen for th

CHAMELEON THANKS

Research WP leads: **Peter Woitke**, **Leen Decin**, **Uffe G. Jørgensen**
(remember the final reports!)

WP Training lead: **Inga Kamp**
Michiel Min & Ludmila Carone (School organization)

WP Recruiting: **Paul Palmer**

WP Arts & Outreach leads: **Katrien Kolenberg** & **Anja C. Andersen**

ESR representatives: **Sven Kiefer, Thorsten Balduin, Nanna Bach-Møller, Pieter Steyaert**

All our local administrations, in particular **Ruth-Sophie Taubner**.

CHAMELEON CONFERENCE IN COPENHAGEN

CHAMELEON:

MARIE CURIE ACTIONS

Opening the floor to other supervisors: